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A. Relevance of the Above-identified Document

The following is a partial English translation of exemplary portions of non-English language information that may be relevant to the issue of patentability of the claims of the present application.

B. Translation of the Relevant Passages of the Document

See also the attached English Abstract.

[EMBODIMENTS]

[0072]

On the other hand, the ink supply unit 205 is provided with an ink supply needle 205a for deriving ink 209 from the main tank 204, and an air introducing needle 205b for introducing air into the main tank 204. The ink supply needle 205a and the air introducing needle 205b are both hollow needles and are positioned, with the front ends upwards, corresponding to the ink supply port and the air introducing port of the main tank 204. When the main tank 204 is mounted on the ink supply unit 205, the ink supply needle 205a and the air introducing needle 205b respectively penetrate the rubber stoppers 204b, 204c, thus entering the interior of the main tank 204.

[0073]

The ink supply needle 205a is connected, through a liquid path 205c, a shut-off valve 210 and a liquid path 205d, to the ink supply tube 206. The air introducing needle 205b is connected, through a liquid path 205e, a buffer chamber 205f and an air communicating aperture 205g, to the external air. The liquid path 205c lowest in height within the ink supply path from the ink supply needle 205a to the ink supply tube 206 and the liquid path 205e highest in height within the path from the air introducing needle 205b to the air communicating aperture 205g are positioned same in height. The ink supply needle 205a and the air introducing needle 205b in the present embodiment are composed of thick needles of an internal diameter of 1.6 mm and have needle holes of a diameter of 1 mm to 1.5 mm in order to suppress the flow resistance of the ink.

[0074]

The shut-off valve 210 is provided with a rubber diaphragm 210a which is displaced to open or close the connection between the two liquid paths 205c, 205d. On the upper surface of the diaphragm 210a, there is mounted a tubular spring holder 210b containing therein a compression spring 210c which serves to press the diaphragm 210a thereby closing the connection between the liquid paths 205c, 205d. The spring holder 210b is

provided with a flange, engaging with a lever 210d to be operated by a link 207e of a recovery unit 207 to be explained later. By activating the lever 210d to lift the spring holder 210b against the spring force of the compression spring 210c, the connection between the liquid paths 205c, 205d is opened. The shut-off valve 210 is opened during the ink discharge from the recording head 201 but is closed during a stand-by state or in a non-operated state, and is opened and closed in synchronization with the recovery unit 207 during an ink filling operation to be explained later.

[0075]

The above-described configuration of the ink supply unit 205 is provided for each main tank 204, namely for each ink color, except for the lever 210d. The lever 210d is provided common to all colors and simultaneously opens or closes the shut-off valves 210 for all the colors.

[0076]

In the above-described configuration, when the ink is consumed in the recording head 201, the resulting negative pressure causes the ink to be from time to time supplied from the main tank 204 to the recording head 201 through the ink supply unit 205 and the ink supply tube 206. At this operation, air of an amount same as that of the supplied from the main tank 204 is introduced into the main tank 204 from the air communicating aperture

205g through the buffer chamber 205f and the air introducing needle 205b.

[0077]

The buffer chamber 205f provides a space for temporarily holding the ink flowing out of the main tank 204 by the inflation of gas in the main tank 204, and the lower end of the air introducing needle 205b is positioned at the bottom of the buffer chamber 205f. In case the gas in the main tank 204 expands by an increase in the ambient temperature or a decrease in the external pressure during a stand-by state or a pause of the ink jet recording apparatus, since the shut-off valve 210 is closed, the ink in the main tank 204 flows out to the buffer chamber 205f through the air introducing needle 205b and the liquid path 205e. On the other hand, the gas in the main tank 204 contracts for example by a decrease in the ambient temperature, the ink flowing out in the buffer chamber 205f returns to the main tank 204. Also in case the recording head discharges ink while the ink is present in the buffer chamber 205f, at first the ink in the buffer chamber 205f returns to the main tank 204 and the gas is introduced into the main tank 204 after the ink in the buffer chamber 205f is depleted.

[0078]

The volume V_b of the buffer chamber 205f is so selected as to satisfy the environmental use condition of

the product. For example, for a product to be used within a temperature range of 5C° (278K) to 35C° (308K), and for a main tank 204 having a volume of 100 ml, the volume V_b is selected as 100 × (308 - 278)/308 = 9.7 ml or larger.

[0079]

Now there will be explained, with reference to Figs. 3, the basic water head of the main tank 204 and the behavior of gas and ink in the liquid path of the ink supply unit 205 at the gas introduction into the main tank 204.

[0080]

Fig. 3(a) shows a normal state capable of ink supply from the main tank 204 to the recording head 201 (cf. Fig. 2). In this state, the interior of the main tank 204 is maintained air-tight except for the buffer chamber 205f and is maintained at a negative pressure relative to the atmospheric pressure, and the front end 209a of the ink remains in the liquid path 205e. The front end of the ink is in contact with air and is therefore at the atmospheric pressure (= 0 mmAq). The liquid path 205c in which the front end 209e of the ink is positioned and the liquid path 205e communicating with the ink supply tube 206 (cf. Fig. 2) are of a same height and mutually communicate only through the ink, so that the pressure of the liquid path 205c is also the atmospheric pressure. This pressure is determined only by the height relationship of the front end

209a of the ink and the liquid path 205c and is not influenced by the amount of ink 209 in the main tank 204.

[0081]

As the ink in the main tank 204 is consumed, the front end 209a of the ink gradually move toward the air introducing needle 205b as shown in Fig. 3(b), and, upon reaching a position directly below the air introducing needle 205b, the air floats as a bubble in the air introducing needle 205b as shown in Fig. 3(c) and introduced into the main tank 204. In return, the ink in the main tank 204 enters the interior of the air introducing needle 205b, whereby the front end 209a of the ink returns to the original state shown in Fig. 3(a).

[0082]

Fig. 3(d) shows a state where ink is accumulated in the buffer chamber 205f. In this state, the front end 209a of the ink is at a position in the middle of the height of the buffer chamber 205f and higher than the liquid path 205c by h1 (mm) so that the pressure in the liquid path 205c is -h1 (mmAq).

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最終頁に続く

(54)【発明の名称】　液体供給システム、インクジェット記録ヘッド、インクジェット記録装置、および液体充填方法

(57)【要約】
【課題】　無駄なインクをできるだけ少なくしつつ、フィルタの下流側に生じる気泡による不具合を防止する。
【解決手段】　記録ヘッド２０１は、外部から供給されたインクを蓄えるサブタンク部２０１ｂと、サブタンク部２０１ｂから供給されたインクを蓄え、インクを吐出するノズル２０１ｇにインクを直接供給する液室２０１ｆとを有する。サブタンク部２０１ｂと液室２０１ｆとの間にはフィルタ２０１ｃが設けられる。液室２０１ｆは、液室２０１ｆ内のインクとフィルタ２０１ｃとの間気体で隔てられるように、所定の量のインクを保持している。